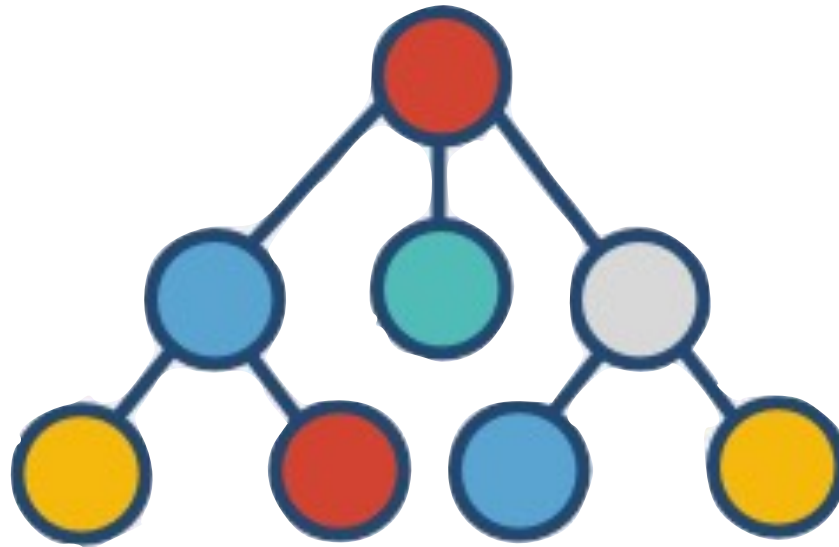


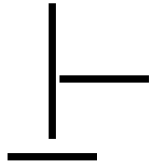
# DATA STRUCTURE & ALGORITHMS



**(By Prince Agarwal)**  
**[ “HELLO WORLD” ]**

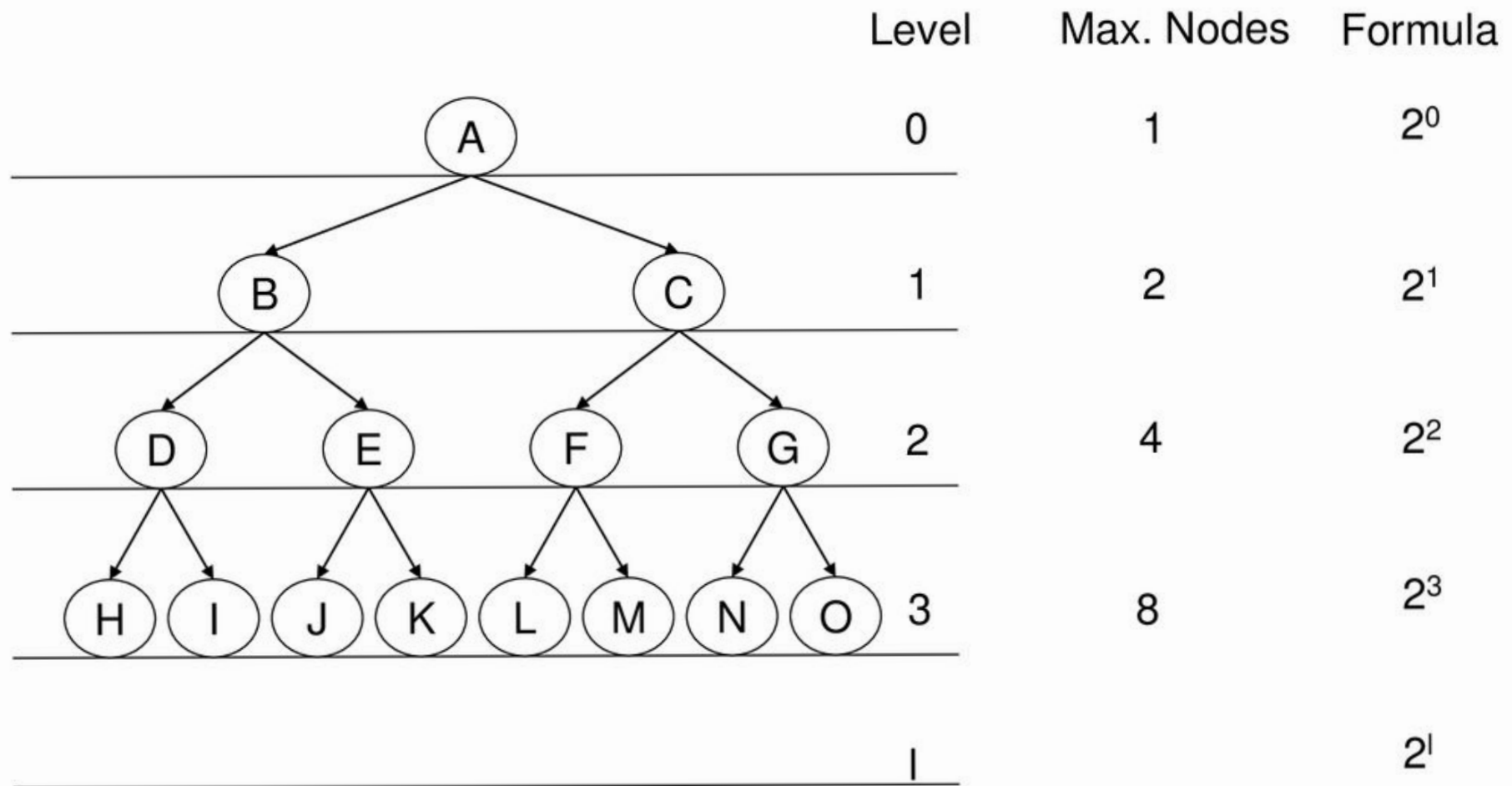
## PROPERTIES OF BINARY TREE IN C++

### ■ PROPERTIES OF BINARY TREE ?



■ The maximum number of nodes at level 'l' of a binary tree is  $2^l$ .

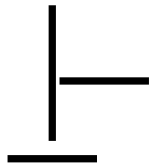
## PROPERTIES OF BINARY TREE IN C++



Hello world

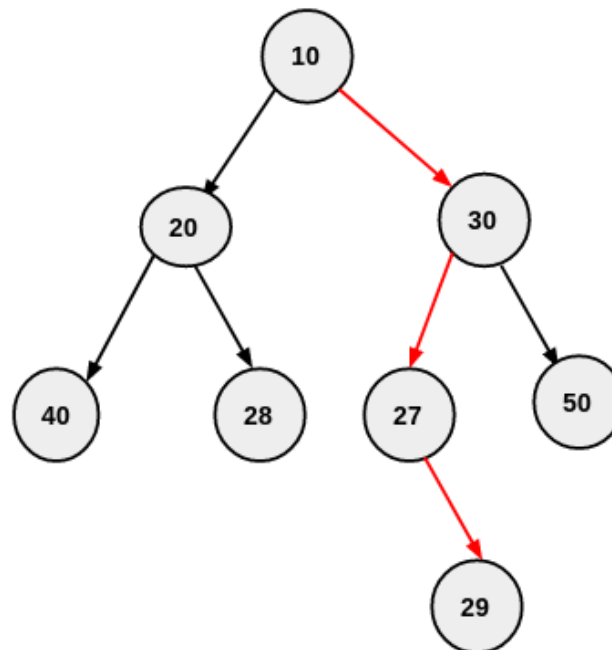
## PROPERTIES OF BINARY TREE IN C++

### PROPERTIES OF BINARY TREE ?



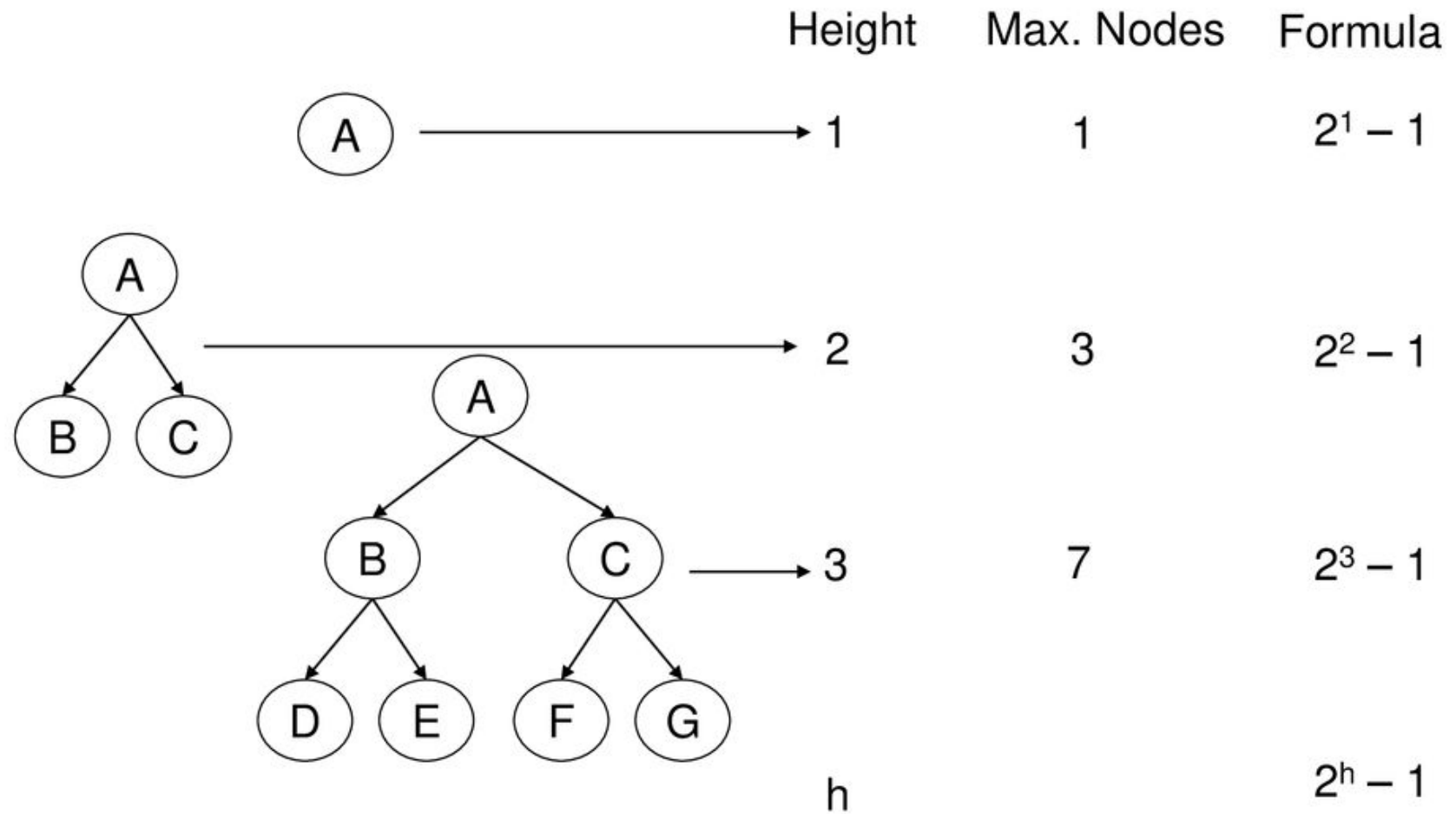
Maximum number of nodes in a binary tree of height 'h' is  $2^h - 1$ .

### Height of Tree



Hello world

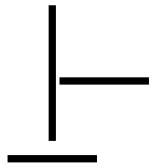
## PROPERTIES OF BINARY TREE IN C++



Hello world

## PROPERTIES OF BINARY TREE IN C++

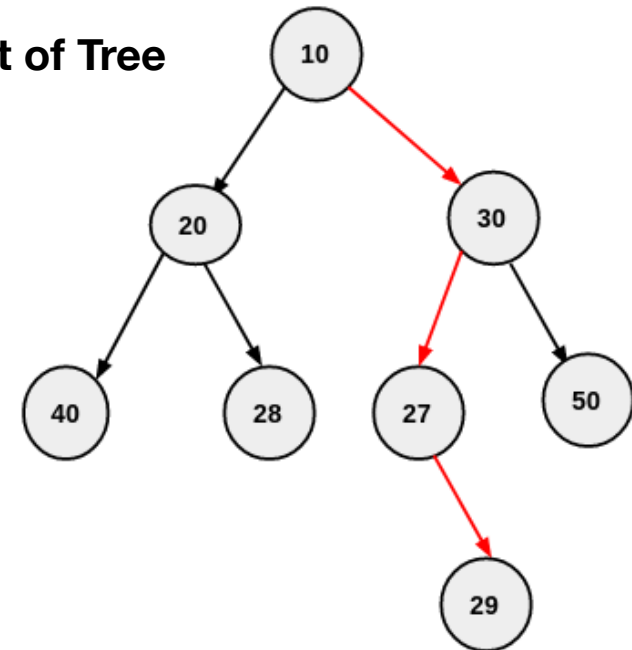
### PROPERTIES OF BINARY TREE ?



Maximum number of nodes in a binary tree of height 'h' is  $2^h - 1$ .

In some books, height of the root is considered as 0. In this convention, the above formula becomes  $2^{h+1} - 1$

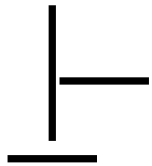
### Height of Tree







Hello world

## PROPERTIES OF BINARY TREE IN C++

### PROPERTIES OF BINARY TREE ?



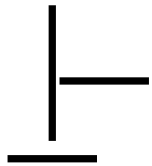
In a Binary Tree with N nodes, **minimum** possible height or minimum number of levels is ?  $\log_2(N+1) - 1$

	Level	Max. Nodes	Formula	N nodes	→.	$2^{h+1} - 1$	(if Level = 0)
	0	1	$2^0$				
	1	2	$2^1$	( N + 1 ) nodes	→.	$2^{h+1}$	
	2	4	$2^2$	( N + 1 ) nodes	→.	$2^{h+1}$	
	3	8	$2^3$	( N + 1 ) nodes	→.	$2^{h+1}$	
				$\log_2(N+1)$ nodes	→.	H + 1	

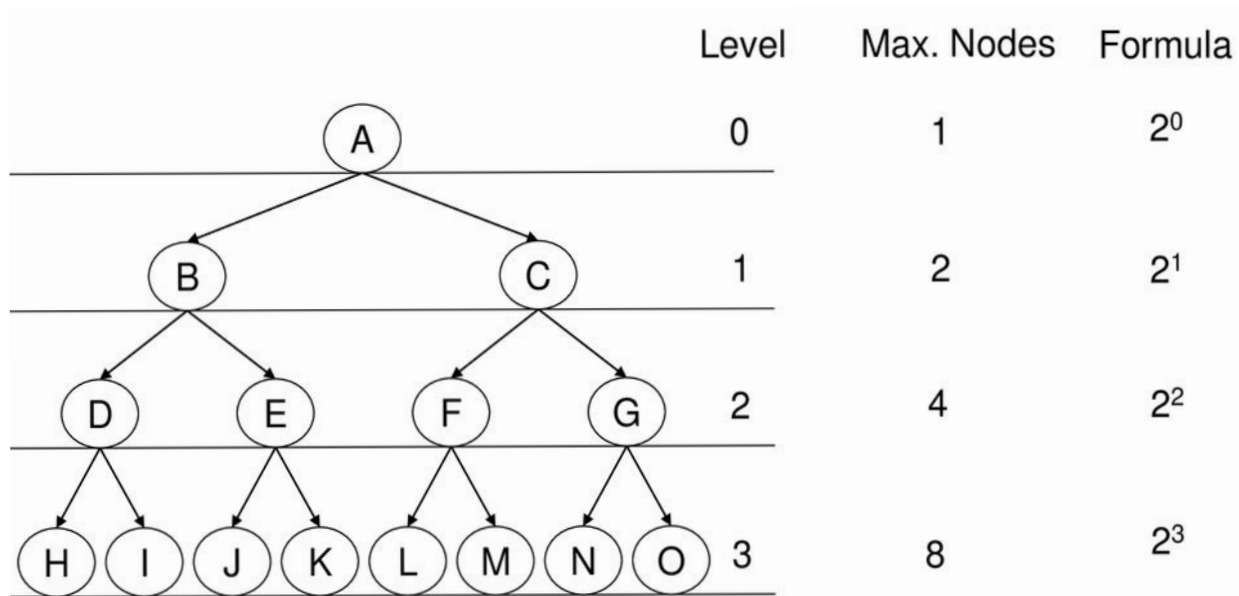
Hello world

## PROPERTIES OF BINARY TREE IN C++

### PROPERTIES OF BINARY TREE ?



In Binary tree where every node has 0 or 2 children,  
**number of leaf nodes** is always **one** more than **nodes with two children**.



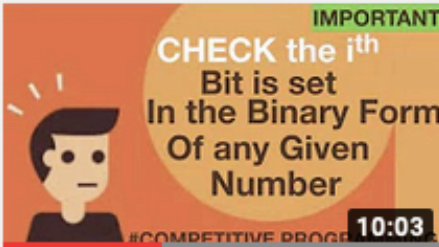




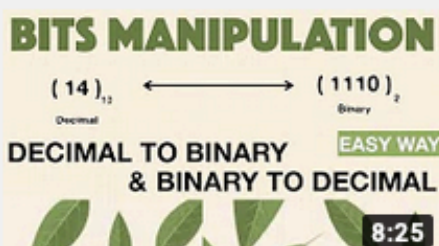
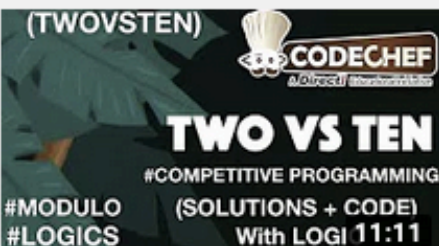








Total no. of Nodes with 2 children = 7

So, Total number of leaf Nodes. =  $7+1 = 8$

If you want Proof Then Please  
**Handshaking Lemma**

hello world



 <p><b>CHECK the <math>i^{\text{th}}</math> Bit is set In the Binary Form Of any Given Number</b></p> <p>IMPORTANT</p> <p>#COMPETITIVE PROGRAMMING 10:03</p>	 <p><b>COUNT THE NUMBER OF ONE'S PRESENT IN BINARY NUMBER</b></p> <p>VERY EASY</p> <p>#COMPETITIVE PROGRAMMING 13:44</p>	 <p><b>CHECK GIVEN NUMBER IS POWER OF 2 ?</b></p> <p>EASY WAY</p> <p>(FULL EXPLANATION WITH CODE)</p> <p>#BITWISE #BINARY</p> <p>HW Hello World</p> <p>#COMPETITIVE PROGRAMMING 15:28</p>	 <p><b>LEFT SHIFT RIGHT SHIFT BITWISE OPERATOR</b></p> <p>EASY WAY</p> <p>(PART - 02)</p> <p>#COMPETITIVE PROGRAMMING 15:24</p>	 <p><b>AND NOT XOR OR BITWISE OPERATOR</b></p> <p>EASY WAY</p> <p>(PART - 01)</p> <p>#COMPETITIVE PROGRAMMING 13:06</p>
<p>Check the <math>i^{\text{th}}</math> bit is set, in the binary form of given number...</p> <p>1.1K views • 1 year ago</p>	<p>Count the number of one's in binary representation of...</p> <p>1.6K views • 1 year ago</p>	<p>Check a given number is power of 2   Bitwise operator...</p> <p>3.2K views • 1 year ago</p>	<p>Left shift and right shift bitwise operator   ...</p> <p>1.4K views • 1 year ago</p>	<p>Bitwise Operators   AND   NOT   OR   XOR    Competitive...</p> <p>1.8K views • 1 year ago</p>
 <p><b>BITS MANIPULATION</b></p> <p>(14)<sub>10</sub> ↔ (1110)<sub>2</sub></p> <p>Decimal Binary</p> <p><b>DECIMAL TO BINARY &amp; BINARY TO DECIMAL</b></p> <p>EASY WAY</p> <p>#8:25</p>	 <p>(TWOVSTEN)</p> <p><b>TWO VS TEN</b></p> <p>#COMPETITIVE PROGRAMMING</p> <p>#MODULO #LOGICS</p> <p>(SOLUTIONS + CODE) With LOGI 11:11</p>	 <p>(CHEFROUT)</p> <p><b>CHEF AND HIS DAILY ROUTINE</b></p> <p>#COMPETITIVE PROGRAMMING</p> <p>(SOLUTIONS + CODE) With LOGI 12:56</p>	 <p><b>EUCLIDEAN ALGORITHM</b></p> <p>FINDING GCD OF TWO NUMBERS</p> <p>#COMPETITIVE PROGRAMMING</p> <p>12:31</p>	 <p><b>SIEVE OF ERATOSTHENES</b></p> <p>PART - 02 (CODE)</p> <p>#COMPETITIVE PROGRAMMING 12:01</p>
<p>Bits Manipulation   Decimal to Binary   Binary to Decimal...</p> <p>1.5K views • 1 year ago</p>	<p>Program of Two vs Ten Codechef - TWOVSTEN   ...</p> <p>1.3K views • 1 year ago</p>	<p>Program of chef and his daily routine - CHEFROUT   ...</p> <p>1.7K views • 1 year ago</p>	<p>Euclidean algorithm for finding GCD of 2 numbers   ...</p> <p>2K views • 1 year ago</p>	<p>Sieve of Eratosthenes -part 2    Competitive programming...</p> <p>2.2K views • 1 year ago</p>
 <p><b>SIEVE OF ERATOSTHENES</b></p> <p>PART - 01 (LOGIC)</p> <p>#COMPETITIVE PROGRAMMING 8:38</p>	 <p>#Concept / Program of #Prime Numbers</p> <p><b>CONCEPT OF PRIME NUMBERS</b></p> <p>#COMPETITIVE PROGRAMMING 13:38</p>	 <p>VERY IMPORTANT CONCEPTS</p> <p>#memset() function #In C/C++</p> <p><b>USE OF MEMSET()</b></p> <p>#COMPETITIVE PROGRAMMING 12:00</p>	 <p>(FANCY)</p> <p><b>FANCY QUOTES</b></p> <p>#COMPETITIVE PROGRAMMING (SOLUTIONS + CODE) With LOGI 15:46</p> <p>#Strings #getline()</p>	 <p>(ALPHABET)</p> <p>#Clears String Concept #String</p> <p><b>STUDYING ALPHABET</b></p> <p>#COMPETITIVE PROGRAMMING (SOLUTIONS + CODE) With LOGIC 24:28</p>
<p>Sieve of Eratosthenes -part 1    Competitive programming...</p> <p>3.4K views • 1 year ago</p>	<p>Program and concept of prime numbers.   ...</p> <p>2.1K views • 1 year ago</p>	<p>memset() function in C/C++ and its syntax.    Competitive...</p> <p>4.3K views • 1 year ago</p>	<p>problem of Fancy Quotes    getline() in strings --FANCY...</p> <p>2.1K views • 1 year ago</p>	<p>Concept of Handling the String related problems -...</p> <p>3.4K views • 1 year ago</p>

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